

Atypical geochemistry of the lherzolite enclave in the Paleoproterozoic Bug Granulite complex – participation of the chondrite material?

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An enclave of a small (~30 * 300 sm) lens-like body [N56°30', E13°50'] of spinel lherzolite occurs in the Paleoproterozoic orthogneiss of the Bug complex of the Ukrainian Shield which experienced multistage metamorphism and deformation [Claesson et al., 2006; Lobach-Zhuchenko et al., 2016]. The spinel lherzolite lens is mantled by a thin rim of a phlogopite websterite at the contact with the host orthogneiss. The spinel lherzolite consists of Ol (Fo 85), Opx (#Mg 0.86), Cpx (#Mg 0.92), minor Phl (#Mg 0.92), Cr-Spl, Srp, Pn (Fe 4.3 Ni 4.6 S 8), Mel, Ccp, Crb, Mag, Ap. A mineral assemblage of the websterite is the same except for the minor or absence of Ol and more concentration of Phl.

While the mineral composition of the lherzolite is usual for the mantle ultramafic rocks its geochemistry is atypical (SiO₂ - 41.04 wt%, TiO₂ - 0.26, Al₂O₃ - 1.62, Fe₂O₃ - 3.88, FeO - 7.75, MnO - 0.18, MgO - 38.90, CaO - 0.61, Na₂O - 0.09, K₂O - 1.12, P₂O₅ - 0.02, LOI - 3.37, CO₂ - 0.85, S - 0.08 wt%). The main distinctions of this rock include (1) low # Mg (0.86) relative to PM and mantle xenoliths [Pearson et al., 2003], (2) high abundance of Ni - average 3737 ppm versus 1960 ppm in PM [Palme & O'Neil, 2003] and as a consequence olivine enriched in Ni relative to its Mg-number [Mysen, 2006; Herzberg et al., 2016], (3) high Ni/Cr = 4.76 and Ni/Co = 21.56 versus PM with Ni/Cr = 0.74; Ni/Co = 18.20 [Palme & O'Neil, 2003] and as compared with other terrestrial ultramafics, for instance, relative to orogenic lherzolite (Ni = 2024; Ni/Cr = 0.78; Ni/Co = 18.4) [Lorand et al., 2000].

It is known that such high ratios are typical for all types of chondrites, e.g., the ratios in C1, C2, C3, L, E chondrites are: Ni/Cr = 2.9-5.3, Ni/Co = 21-29 [Mason, 1971; Sobotovich, 1986]. Probably, the geochemistry of the studied lherzolite inclusion assumes participation of the chondrite material in its formation during some impact event in the past.